



# National Forests

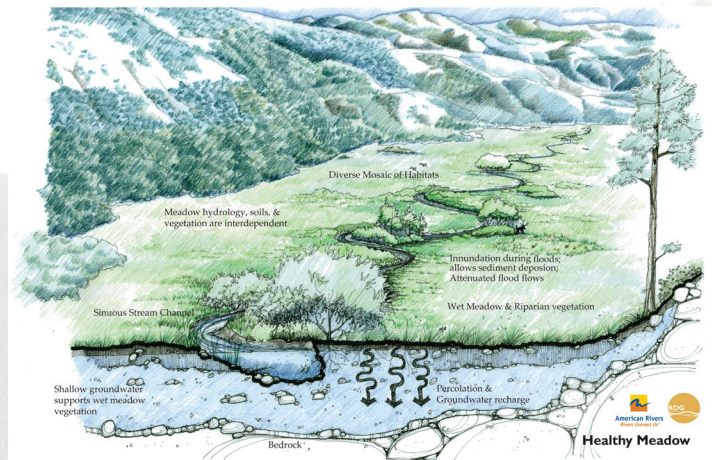
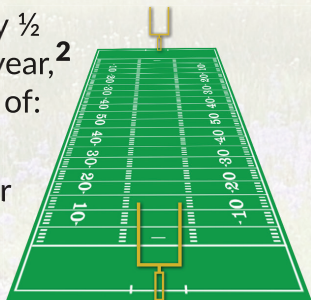
In CALIFORNIA

# Nature's Benefits MEADOWS

## SIERRA NEVADA MEADOWS

### WHAT IS A MEADOW?

- A meadow is an area where shallow groundwater enables grass-like plants and wildflowers to flourish.
- The Sierra Nevada Meadows has more than 18,000 meadows comprising almost 280,000 acres of which 102,000 acres are located on California's National Forests.<sup>1</sup>
  - The largest, the Monache Meadow, is nearly 4,600 acres and is located on the Inyo and Sequoia National Forests.
- On average, restoring one acre of meadow increases water yield by  $\frac{1}{2}$  acre foot of water per year,<sup>2</sup> which is the equivalent of:
  - Covering a football field 6 inches deep, or enough water for an average CA family for 1 year.<sup>3</sup>



## WHY DO MEADOWS MATTER?

### WATER STORAGE AND FLOW/ GROUNDWATER IN THE SIERRA NEVADA

Meadows in the Sierra Nevada retain and release water and are critically important for the hydrology of California. In fact, over 60% of the state's water supply originates in the Sierra Nevada,<sup>4</sup> for which meadows are key components, helping to regulate water flow, temperature, and quality.

- During springtime snowmelt, high stream flows overtop streambanks and flood across healthy meadows sinking into the soil where it is stored as shallow groundwater.
- Groundwater moves very slowly through the meadows, adding cool flow during the summer, when water is most needed.

#### SOURCES

<sup>1</sup><https://meadows.ucdavis.edu/news/meadows-gis-layer-v20-released>

<sup>2</sup>This number comes from an average across 64,000 acres of meadow) [https://ehp.niehs.nih.gov/wp-content/uploads/2017/07/EHP1663.alt\\_.pdf](https://ehp.niehs.nih.gov/wp-content/uploads/2017/07/EHP1663.alt_.pdf), Nature Contact and Human Health: A Research Agenda Howard Frumkin, 1 Gregory N. Bratman, 2, 3, 4 Sara JoBreslow, 3 Bobby Cochran, 5 Peter H. Kahn Jr, 4, 6 Joshua J. Lawler, 3, 4 Phillip S. Levin, 4, 7 Pooja S. Tandon, 1, 8, 9 Usha Varanasi, 10, 11 Kathleen L. Wolf, 4, 12 and Spencer A. Wood, 3, 4, 13

<sup>3</sup><https://sustainability.ucsc.edu/get-involved/student-projects/water-drought/images-and-files/California%20Water%20Facts.pdf>

<sup>4</sup><http://www.sierranevada.ca.gov/our-region/ca-primary-watershed>

#### CREDITS

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Meadow background photo by Robin Gyorgyfalvy

Healthy and unhealthy meadow graphics with permission from [americanrivers.org](http://americanrivers.org)

- When we restore meadows by filling deeply-eroded channels, we restore this flooding and seasonal water storage. Some streams that used to dry out during summer now run all year long, even during droughts.
- Meadow restoration reduces springtime flow and increases summer flows.
- For ranchers, restoration increases forage quantity and quality, reduces need for local irrigation, and increases range productivity by 300-500%.<sup>5</sup>

## CRITICAL HABITAT

Meadows in mid-summer are a critical Sierran habitat requirement for many plant and animal species.<sup>6</sup>



Healthy meadows are natural sponges that soak up spring snowmelt and provide water during dry summer months. They also provide habitat for:

- Endangered Great Gray Owls, one of the world's largest owls, are a focus of the conservation strategy developed by the Institute for Bird Populations that identifies meadow restoration as a priority action;
- Endangered Greater Sandhill Cranes which breed in wet meadows of North Eastern California;
- California's Species of Concern and California State fish, the Golden Trout which is native to the meadows of Kern Plateau which were heavily impacted by grazing.
- Migratory birds in the Sierra Nevada;
- Some of the highest levels of plant biodiversity on California's National Forests;<sup>7</sup> and

- Grazing for cattle and other livestock by providing nutrient-rich forage.<sup>8</sup>

## CULTURAL VALUE



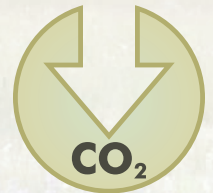
Meadows have served as important Native American gathering sites for thousands of years, and have been kept fertile and open by burning and regular visits, for many generations.<sup>9</sup>

Historically, some meadows in the Sierra Nevada were overgrazed by domestic livestock which impaired the hydrologic function of these landscapes and decimated a reliable food source for California's indigenous people, as nutritious perennial grasses were replaced with invasive non-native plants.<sup>10</sup>

In spite of these negative impacts to meadows, these landscapes continue to be high priority for the revival and perpetuation of indigenous culture and biodiversity in the Sierra Nevada.

## CARBON SEQUESTRATION

- Though meadows cover only 2% of the Sierra Nevada landscape, they may contain roughly 1/3 of the landscape's soil organic carbon.<sup>11</sup>
- Preliminary research indicates that healthy meadows are net carbon sinks, whereas degraded meadows are net carbon emitters to the atmosphere.<sup>12</sup>



## RECREATION

- There is increasing evidence that regular contact with nature and greenspace, to include forests, meadows and grasslands positively affects physical health and mental well-being by reducing stress, enhancing mood and offering a restorative environment allowing people to escape from the stresses of urban life.<sup>13</sup>



<sup>5</sup>Tate et al. 2011 <http://s3.amazonaws.com/american-rivers-website/wp-content/uploads/2016/06/21173418/5-Forage-Model.pdf> A report to NFWF.

<sup>6</sup>Graber, D. M. Status of terrestrial vertebrates. in Sierra Nevada ecosystem project: final report to Congress 2, 709-726 (1996); Fites-Kaufman, J. A., Rundel, P., Stephenson, N.

<sup>7</sup>Fites-Kaufman, J. A., Rundel, P., Stephenson, N.

<sup>8,11</sup>Norton, J.B., Jungst, L.J., Norton, U., Olsen, H.R., Tate, K.W. and Horwath, W.R., 2011. Soil carbon and nitrogen storage in upper montane riparian meadows. *Ecosystems*, 14(8), pp.1217-1231.

<sup>9,10</sup>Anderson, M.K., 2005. *Tending the Wild*. University of California Press: Berkeley and Los Angeles, California. Cunningham, F. 2007. *Maidu Summit Consortium Land Management Plan Proposal and Working Document for the Pacific Forest and Watershed Lands Stewardship Council*. Maidu Summit Consortium: Greenville, CA.

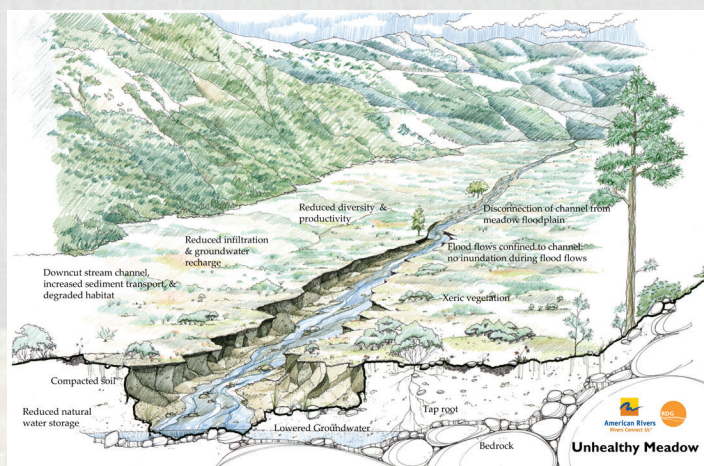
<sup>12</sup>CA Sierra Meadows Partnership May 2018 Workshop

<sup>13</sup>[https://www.tandfonline.com/doi/pdf/10.1080/19438150903378425?needAccess=true&\(Ulrich\)](https://www.tandfonline.com/doi/pdf/10.1080/19438150903378425?needAccess=true&(Ulrich))

- Meadows also offer scenic value and recreation such as walking, bird-watching, and fishing, which have been found to contribute to psychological, spiritual, and physical wellness.<sup>14</sup>

## IMPACT OF UNHEALTHY MEADOWS

It is estimated that 50% of all Sierra Nevada Meadows on California National Forests are in need of restoration, or about 51,000 acres.<sup>15</sup>



- As a result of the backlog, these meadows, to varying degrees, are not able to provide Nature's Benefits that support people, plants and animals.

## ACTIONS TAKEN

The California Water Action Plan (WAP) was developed to move California toward more sustainable water management and includes three objectives:

1. More reliable water supplies;
2. Restoration of important species and habitat, and
3. A more resilient sustainable managed water resources system which would encompass healthy meadows

State Initiatives such as Proposition 1 and the California Climate Initiatives (Cap-and-Trade) have restoration programs focused specifically on meadows.



The 2015 Pacific Southwest Region's Leadership Intent document speaks to restoration efforts that would restore at least 50% of accessible, degraded forest meadows. This would improve meadow habitat function and the ability to hold water longer into the summer when water is most needed.

The 2017 Sierra Meadows Partnership (over 20 partners), spearheaded by California Trout and a broad coalition of partners, signed a Memorandum of Understanding to restore and protect 30,000 acres of mountain meadowlands in the greater Sierra Nevada of California within 15 years.

## PARTNERSHIPS

Partnerships with downstream businesses and other users rely on the benefits of clean and available drinking water for household purposes, irrigation, recreation, and economic prosperity. It is our California upper watersheds, which include meadows, that provides the water we all rely on.

## THE PROBLEM AND HOW YOU CAN HELP

National Forests provide an abundance of Ecosystem Services, or Nature's Benefits, to the people of California: from drinking water to recreation opportunities, to carbon sequestration, to local jobs and income. Exacerbated by the growing impacts of climate change, our history of fire suppression and extensive logging, has resulted in our National Forests experiencing dramatic increases in wildfire size, frequency, and severity,<sup>1,2</sup> as well as other disturbance events like tree mortality.

In turn, these practices, along with climate change—causing increased drought frequency and higher temperatures, threaten the Nature's Benefits people and communities rely on in their daily lives.<sup>3,4</sup> To restore forest health, we need to increase the pace and scale of forest restoration across the state. Communicating the Nature's Benefits from California's National Forests and sharing a stewardship vision to bring more resources to bear for restoration, can sustain these benefits for future generations.

### SOURCES

<sup>1</sup>Westerling, A. L., Hidalgo, H. G., Cayan, D. R., & Swetnam, T. W. (2006). Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. *Science*, 313(5789), 940–943. <https://doi.org/10.1126/science.1128834>

<sup>2</sup>Miller, J. D., & Safford, H. (2012). Trends in wildfire severity: 1984 to 2010 in the Sierra Nevada, Modoc Plateau, and southern Cascades, California, USA. *Fire Ecology*, 8(3), 41–57. <https://doi.org/10.4996/fireecology.0803041>

<sup>3</sup>California's Fourth Climate Change Assessment - <http://www.climateassessment.ca.gov/>

<sup>4</sup>Williams, A. P., Allen, C. D., Macalady, A. K., Griffin, D., Woodhouse, C. A., Meko, D. M., ... McDowell, N. G. (2013). Temperature as a potent driver of regional forest drought stress and tree mortality. *Nature Climate Change*, 3(3), 292–297. <https://doi.org/10.1038/nclimate1693>

<sup>14</sup>[https://ehp.niehs.nih.gov/wp-content/uploads/2017/07/EHP1663.alt\\_.pdf](https://ehp.niehs.nih.gov/wp-content/uploads/2017/07/EHP1663.alt_.pdf), Nature Contact and Human Health Howard Frumkin, 1 Gregory N. Bratman, 2, 3, 4 Sara JoBreslow, 3 Bobby Cochran, 5 Peter H. Kahn Jr., 4, 6 Joshua J. Lawler, 3, 4 Phillip S. Levin, 4, 7 Pooja S. Tandon, 1, 8, 9 Usha Varanasi, 10, 11 Kathleen L. Wolf, 4, 12 and Spencer A. Wood, 3, 4, 13

<sup>15</sup>Sierra Nevada Partnership, Sierra Meadows Strategy, Nov 2016. <http://caltrout.org/book/sierra-meadows-strategy/mobile/index.html>